

## How Many Things by Season Season'd Are

*Seasons of Life: The biological rhythms that living things need to thrive and survive.* By Russell G. Foster and Leonard Kreitzman. Pp. 303. Profile Books, London. R237.56. ISBN 978-1-86197-918-4. 2009.

People born between June and September in the southern hemisphere are more likely to suffer from schizophrenia than those born in other months; a quarter of the entire genome of *Arabidopsis thaliana* (a cress plant) is devoted to sensing and responding to environmental changes; and human basal metabolic rate drops to 40% of normal values during starvation. These are some of the many remarkable facts that I learned while reading this book, which successfully unites wide-ranging discussions of plant phenology, animal behaviour and evolutionary physiology; the seasonality of human disorders as diverse as malaria and seasonal affective disorder; and the timing of crime and of human reproductive rhythms—all in the context of climate change. This is the second book by the neurobiologist/science writer team that produced a well-received description of circadian rhythms,

*Rhythms of Life*, in 2004. *Seasons of Life* takes a wider perspective, addressing organisms' anticipation of and responses to the environmental changes that follow seasonal rather than daily rhythms. Many biologists will share the authors' concluding wish for a better understanding of biological rhythms, in the hope that this might improve our chances of slowing down the accelerating extinction rate resulting from climate change.

The opening chapter summarises why the earth has seasonal weather: the angle of its axis; the shape of its orbit around the sun; and the physics of heat flow through its atmosphere and oceans. Then, after introducing some ecological case studies of evolutionary adaptation to seasonal changes, Foster and Kreitzman give us detailed descriptions of the key signalling and transcription pathways underlying seasonal rhythms in both plants and

animals. These rhythms are based on intrinsic physiological clocks that are fine-tuned by environmental cues: light periodicity and intensity, and also temperature. The clocks' mechanisms and the histories of their discovery are fascinating. Russell Foster's own research was central to the understanding of non-retinal light receptors in vertebrates, and his account of these clocks is masterful, if sometimes difficult to follow. His interest in light as a stimulus probably led to the book's emphasis on this, and to the neglect of environmental cues such as water availability, which is probably important in dry environments. More accessible than the descriptions of cellular and physiological function are the multifaceted and wide-ranging discussions in the second half of the book about seasonal patterns in humans, who originated in the tropics but whose range has now expanded to include all latitudes.

The influence of the pharmaceutical industry on medical science is illustrated by the recent history of medical research into and treatment of seasonal affective disorder—the depression and loss of



Disko Island, West Greenland (photo: Nadine Gerth). Humans living at high latitudes such as these run the risk of suffering from seasonal affective disorder.

energy and appetites in the dark months of winter that affect humans living at high latitudes. In the 1980s, a research team at the National Institute of Mental Health in Maryland made good progress using light therapy to counteract this syndrome. Their results notwithstanding, the current trend in the U.S.A. is away from light-based (hence inexpensive and drug-free) cures. Recent disbanding of this research team, and continued neglect of light therapy in favour of drug-based solutions to the problem, suggest that the profit motives of the pharmaceutical

industry play a strong role in determining state health policy.

I suspect that the authors may lose lay readers in the first few chapters, where their explanations presuppose a molecular or physiological background. And especially as it traverses many fields, the book would have benefitted from a good edit. The authors appear to have aimed to please both scientists and lay people, but they risk doing neither. For example, they name the authors of key studies, yet repeatedly (and redundantly) insert text citations in the same sentence as if for a

scientific article. The comprehensive reference list at the end of the book would have been enough without these citations. Numerous verbatim quotes, some well written and some not, detract from rather than enhance the flow of the narrative. And so the book falls short of the engaging read it could have been, given its subject matter and the expertise of its authors.

Most of the literature on seasonal rhythms in plants and animals, including our own species, has emerged from research in North America and Europe, and most examples in the book reflect this. Still, readers in the southern hemisphere may think it strange to see the equinoxes and solstices named for the northern seasons rather than for their calendar months, and may be surprised to learn that the Benguela upwelling off the southwestern coast of Africa starts in June. Such details aside, the sea-dominated nature of the southern hemisphere means that both the nature of climate change itself, and the effects of that change on organisms' seasonal responses, will play out in different ways in the south and in the north. But in both hemispheres, if humans continue to allow short-term economic gains to drive their responses to the challenges of our changed and still-changing world, then the hope expressed at the end of this thoughtful book has little chance of being realised.

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